

11/07/90



# UTILITY PATENT APPLICATION TRANSMITTAL

For nonprovisional applications under 37 CFR § 1.53(b)

Attorney Docket No. 11-08-00

CROSS1360-1

First Inventor or Application Identifier

Steve King, et al.

Title

A Method for Routing HTTP and FTP Services  
Across Heterogeneous Networks

Express Mail Label No.

EL562561698US

3563 U.S. PAT. 09/17/90

00/07/91

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO:

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 20231

1. ☒ Fee Transmittal for FY 2000  
(Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages] 31  
(preferred arrangement set forth below)
  - x - Descriptive Title of the Invention
  - x - Cross References to Related Applications
  - x - Statement Regarding Fed sponsored R & D
  - x - Reference to Microfiche Appendix
  - x - Background of the Invention
  - x - Brief Summary of the Invention
  - x - Brief Description of the Drawings (if filed)
  - x - Detailed Description
  - x - Claim(s)
  - x - Abstract of the Disclosure
3. ☒ Drawing(s) (35 USC 113) [Total Sheets] 4
4. Oath or Declaration [Total Pages] x
  - a. ☒ Newly executed (original or copy)
  - b. ☐ Copy from a prior application (37 CFR 1.63(d))  
(for continuation/divisional with Box 17 completed)
    - i. ☐ **DELETION OF INVENTOR(S)**  
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b)
5. ☐ Incorporation By Reference (useable if box 4b is checked). The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered to be part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Microfiche Computer Program (Appendix)
7. Nucleotide and Amino Acid Sequence Submission  
(if applicable, all necessary)
  - a. ☐ Computer-Readable Copy
  - b. ☐ Paper Copy (identical to computer copy)
  - c. ☐ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

8. ☒ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS) PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Return Receipt Postcard
14. ☐ Small Entity Statement(s) ☐ Statement filed in prior application, Status still proper and desired
15. ☐ Certified Copy of Priority Document(s)  
(if foreign priority is claimed)
16. ☒ Other: Certificate of Express Mail  
Check Nos. 459332 & 459331

17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information below and in a preliminary amendment

☐ Continuation ☐ Divisional ☐ Continuation-In-Part (CIP) of prior Application No.: \_\_\_\_\_

Prior application information: Examiner \_\_\_\_\_ Group / Art Unit \_\_\_\_\_

☒ Claims the benefit of Provisional Application No. 60/202,717; filed May 8, 2000

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PATENT TRADEMARK OFFICE

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SIGNATURE Mark L. Berrier

Date 11/7/90

VAU4024752.1

# FEE TRANSMITTAL

for FY 2001

Patent fees are subject to annual revision.  
Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid.

TOTAL AMOUNT OF PAYMENT (\$ 982.00)

Complete if Known

First Named Inventor Steve King, et al.  
Filing Date November 7, 2000  
Attorney Docket No. CROSS1360-1  
Customer No. 25094  
Group / Art Unit  
Examiner Name

11/07/00  
09/07/28  
JCS13 U.S. PTO

## METHOD OF PAYMENT (check one)

1. ☐ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number 50-0456  
Deposit Account Name Gray Cary Ware & Freidenrich LLP  
☒ Charge Any Additional Fee Required Under 37 CFR §§ 1.16 and 1.17

2. ☒ Payment Enclosed:

☒ Check ☐ Money Order ☐ Other

## FEE CALCULATION

### 1. BASIC FILING FEE

| Large Entity |     | Small Entity |     | Fee Description        | Fee Paid |
|--------------|-----|--------------|-----|------------------------|----------|
| Code         | \$  | Code         | \$  |                        |          |
| 101          | 710 | 201          | 355 | Utility Filing Fee     | 710      |
| 106          | 320 | 206          | 160 | Design Filing Fee      |          |
| 107          | 490 | 207          | 245 | Plant Filing Fee       |          |
| 108          | 710 | 208          | 355 | Reissue Filing Fee     |          |
| 114          | 150 | 214          | 75  | Provisional Filing Fee |          |

SUBTOTAL (1) (\$ 710.00)

### 2. EXTRA CLAIM FEES

| Claims                    | Extra Claims X | Fee from below = | Fee Paid |
|---------------------------|----------------|------------------|----------|
| 29                        | -20            | 9                | 162      |
| Ind. Clms                 | -3             | 0                | 0        |
| Multiple Dependent Claims |                |                  |          |

| Large Entity |     | Small Entity |     | Fee Description   |
|--------------|-----|--------------|-----|---|
| Code         | \$  | Code         | \$  |   |
| 103          | 18  | 203          | 9   | Claims in excess of 20                                  |
| 102          | 80  | 202          | 40  | Indep. claims in excess of 3                            |
| 104          | 270 | 204          | 135 | Multiple dependent claim                                |
| 109          | 80  | 209          | 40  | Reissue indep. claims over original patent              |
| 110          | 18  | 210          | 9   | Reissue claims in excess of 20 and over original patent |

SUBTOTAL (2) (\$ 162.00)

## FEE CALCULATION (continued)

### 3. ADDITIONAL FEES

| Large Entity        |       | Small Entity |       | Fee Description   | Fee Paid |
|---------------------|-------|--------------|-------|---|----------|
| Code                | \$    | Code         | \$    |   |          |
| 105                 | 130   | 205          | 65    | Surchnrg - late filing fee or oath                            |          |
| 127                 | 50    | 227          | 25    | Surchnrg - late provisional filing fee or cover sheet         |          |
| 147                 | 2520  | 147          | 2520  | Filing a request for reexamination                            |          |
| 112                 | 920*  | 112          | 920*  | Request publication of SIR prior to Examiner action           |          |
| 113                 | 1840* | 113          | 1840* | Request publication of SIR prior to Examiner action           |          |
| 115                 | 110   | 215          | 55    | Extension for reply within first month                        |          |
| 116                 | 380   | 216          | 190   | Extension for reply within second month                       |          |
| 117                 | 870   | 217          | 435   | Extension for reply within third month                        |          |
| 118                 | 1360  | 218          | 680   | Extension for reply within fourth month                       |          |
| 119                 | 300   | 219          | 150   | Notice of Appeal  |          |
| 120                 | 300   | 220          | 150   | Filing a brief in support of appeal                           |          |
| 121                 | 260   | 221          | 130   | Request for oral hearing                                      |          |
| 138                 | 1510  | 138          | 1510  | Petition to institute a public use proceeding                 |          |
| 140                 | 110   | 240          | 55    | Petition to revive: unavoidable                               |          |
| 141                 | 1210  | 241          | 605   | Petition to revive: unintentional                             |          |
| 142                 | 1210  | 242          | 605   | Utility issue fee (or reissue)                                |          |
| 143                 | 430   | 243          | 215   | Design issue fee  |          |
| 144                 | 580   | 244          | 290   | Plant issue fee   |          |
| 122                 | 130   | 122          | 130   | Petitions to the Commissioner                                 |          |
| 123                 | 50    | 123          | 50    | Petitions related to provisional applications                 |          |
| 126                 | 240   | 126          | 240   | Submission of Information Disclosure Statement                |          |
| 581                 | 40    | 581          | 40    | Recording each patent assignment per property                 | 40       |
| 146                 | 690   | 246          | 345   | Filing a submission after final rejection (37 CFR § 1.129(a)) |          |
| 149                 | 690   | 249          | 345   | Each additional invention to be examined (37 CFR § 1.129(b))  |          |
| Other fee (specify) |       |              |       |   |          |
| Other fee (specify) |       |              |       |   |          |

\*Reduced by Basic Filing Fee Paid SUBTOTAL (3) (\$ 40.00)

## SUBMITTED BY:

Name Mark L. Berrier  
Signature *alt 7/20*

Registration No. 35,066

Complete (if applicable)

Telephone (512) 457-7000  
Date November 7, 2000

| IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  |   |
|---|---|
| <b>CERTIFICATE OF MAILING BY "EXPRESS MAIL"</b>   | Atty Docket No. (Optional)<br><b>CROSS1360-1</b>  |
| <b>Attn: Box Patent Application</b><br>Hon. Asst. Commissioner of Patents<br>Washington, D.C. 20231 | In the Application of:<br><b>STEVE KING, ET AL.</b>                                       |
|   | Date Filed:<br><b>November 7, 2000</b>  |
|   | Title:<br><b>A Method for Routing HTTP and FTP Services Across Heterogeneous Networks</b> |
|   |   |

jc913 U.S. PTO  
09/10/00  
11/07/00

Sir:

I hereby certify that the enclosures listed below are being deposited with the United States Postal Service "EXPRESS MAIL Post Office to Addressee" service under 37 C.F.R. § 1.10, Mailing Label Certificate No. EL562561698US, on November 7, 2000, addressed to Box Patent Application, Assistant Commissioner for Patents, Washington, DC 20231.

Respectfully submitted,

GRAY CARY WARE ▲ FREIDENRICH LLP

Kerry Thornhill  
Kerry Thornhill

Enclosures:

- Postcard
- Check Nos. 459332 & 459331
- Utility Patent Application Transmittal
- Fee Transmittal for FY 2001
- Specification, 29 Claims, Abstract (31 pages)
- 4 Sheets of Drawings (Figures 1-4)
- Declaration and Power of Attorney
- Form PTO-1595
- Assignment

A METHOD FOR ROUTING HTTP AND FTP SERVICES  
ACROSS HETEROGENEOUS NETWORKS

TECHNICAL FIELD OF THE INVENTION

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The present invention relates in general to the field of electronic devices, and more particularly to an improved method and system for routing data such as HTTP and FTP data across heterogeneous networks.

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BACKGROUND OF THE INVENTION

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Networks may contain a variety of devices which are all coupled to a network medium. The "devices" may include not only individual devices, such as workstations and printers, but also other networks. Typically, the devices on a network are managed through a single one of the devices on the network which queries the other devices for information relevant to management of the system. If the queried devices are on a network other than the network to which the management device is connected, the queries are routed through the respective networks to the queried devices.

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In some networks, management functions are performed through an administrator's workstation which is coupled to the network. The workstation may use a browser to retrieve information on the network devices. The browser is simply pointed to the appropriate devices and the web pages served by the devices are viewed by the administrator on the browser. Management

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of the network may also involve the transfer of data from devices on the network to the administrator's workstation using file transfer protocols. (It should be noted that, while the examples herein generally refer to the management of network devices, the disclosed methods are applicable to other functions which involve the routing of data across heterogeneous networks.

Some systems may include networks which use different, incompatible protocols. For instance, a system may have an ethernet coupled to a Fibre Channel network. Such a system may be referred to as a heterogeneous network. The presence of the incompatible networks may, for example, result from the need for an esoteric or expensive medium to support particular devices such as storage units (e.g., in a storage area network, or SAN). While such an esoteric or expensive medium may be necessary for particular devices, it is often not suitable for distribution of data to devices such as an administrator's workstation.

In heterogeneous network systems, the specialized network (e.g., a Fibre Channel network) is normally a private network that can be accessed only within the system. In other words, it is not publicly accessible from external networks such as the internet. The specialized network is therefore often referred to as an "in-band" network. Conversely, the network to which it is coupled (which is typically externally accessible) is referred to as an "out-of-band" network.

Because the management of heterogeneous network systems is typically handled through an administrator's workstation on the out-of-band network, the incompatibility of the in-band and out-of-band protocols create some difficulty in accessing and managing the devices on the in-band network. In other words, where an administrator can easily request web pages from devices on homogeneous networks and receive responsive web pages, it is not a simple matter to retrieve web pages from devices on the in-band portion of a heterogeneous network.

There are a number of approaches to overcoming these difficulties. One potential solution to this problem would be to incorporate some of the traditional IP gateway functionality into a special purpose gateway to support both the in-band and out-of-band networks. The special purpose gateway would be used as the default gateway for the network and to route IP traffic between the networks. One of the drawbacks of this scheme is that most networks already have default gateway routers in place. Devices on the out-of-band network cannot be reconfigured to use both the special purpose gateway and the gateway that previously served as the default gateway. If the special purpose gateway does not incorporate all of the functionality of the original default gateway, connectivity to the rest of the corporate local area network (LAN) and the internet may be lost. On the other hand, including all of the functionality of the original default gateway requires extensive re-engineering and associated expense.

Another solution would be to use a special purpose proxy server that supports the in-band and out-of-band networks. The proxy would convert messages from one network into messages which are transportable on the other network. One of the drawbacks of this solution is very similar to the problem with the default gateway -- most corporate networks already have proxy servers for local clients, and the clients cannot be reconfigured to use the special purpose proxy server without losing connectivity to the existing (default) proxy server. Alternatively, building all of the functionality of the default proxy server into the special purpose proxy server would involve extensive re-engineering and would increase the cost so much that it would be impractical.

A third solution would be to provide all HTTP and FTP server functionality in the network to support both the in-band and out-of-band networks. This would involve using a custom protocol to retrieve data from the in-band devices. As a result, standard HTTP and FTP services could not be used in the in-band devices. Further, the development of a custom protocol would require a duplication of the engineering effort to address all of the same issues that have already been solved by the standards.

Another solution would be to try to incorporate the web pages for all the disparate devices into the one platform that has an interface to the out-of-band network. This creates another problem, however --

keeping the platform up to date if any of the web pages  
change. From an engineering point of view, this  
solution requires more intelligence to be concentrated  
in one spot than is desirable, and further requires  
5 substantial engineering in its own right.

Another solution would be to physically implement  
the out-of-band network so that each device, including  
those connected to the in-band network, is coupled to  
10 the out-of-band network and is accessible by the  
administrator. The problems with this solution include  
the expense of the additional hardware, the possibility  
that, physically, there may not be available space in  
the out-of-band network, and additional maintenance  
15 will likely be required as a result of the necessary  
hardware.

Yet another solution would be to require that the  
management workstation to be coupled directly to the  
20 in-band network. This typically is not practical  
because in-band networks such as Fibre Channel networks  
generally are not appropriate for distribution of data  
to the workstation.



SUMMARY OF THE INVENTION

One or more of the problems outlined above may be solved by the various embodiments of the invention which, broadly speaking comprises a method and system for routing data across heterogeneous networks.

In one embodiment of the invention, there is provided a system for routing data across a heterogeneous network. The heterogeneous network comprises a specialized in-band network that is privately accessible within the heterogeneous network, as well as an out-of-band network that is coupled to the in-band network by a switching platform such as a network switch. The out-of-band network may be accessible to and from external networks such as the internet via a default gateway, proxy server or similar means. A client is connected to the out-of-band network, and a server is connected to the in-band network.

In this embodiment, the client is configured to transmit a request for server data to the switching platform. The request is formatted according to the protocol of the out-of-band network and may take the form of a uniform resource locator (URL). The switching platform is configured to recognize the request as one which is directed to the server. The switching platform parses the request to determine the requested data and reformats this information as a new request that is transmitted to the server according to

the protocol of the in-band network. The server provides data responsive to the new request, which is transmitted back to the switching platform according to the protocol of the in-band network. The switching platform then reformats the responsive data according to the protocol of the out-of-band network and transmits it to the client.

In another embodiment, there is provided a method for routing data such as TCP service information across a heterogeneous network having an in-band network and an out-of-band network coupled to each other via a network switching platform. The method includes the steps of generating in a client on the out-of-band network a URL, transmitting the URL to the switching platform according to the protocol of the out-of-band network, parsing the request in the switching platform, reformatting the request as a new URL, transmitting the new URL to a server on the in-band network, generating data in the server in response to receiving the new URL, transmitting the data to the switching platform according to the protocol of the in-band network, reformatting the data in the switching platform and transmitting the data to the client according to the protocol of the out-of-band network. In this embodiment, the URL formulated by the client includes an address corresponding to the switching platform, a predetermined key word, an address corresponding to a server on the in-band network and a subject identifying the requested data. The switching platform receives

the URL, identifies the keyword, and parses the URL based upon a URL format indicated by the keyword.

One technical advantage of the present system and method is that they may simplify device management by allowing a unified FTP and/or HTTP interface to network components on both in-band and out-of-band networks. Yet another technical advantage of the present system and method is that they may allow each network component to independently provide HTTP and/or FTP services. This simplifies development efforts since changing the services on one component need not affect the services on other components. Still another technical advantage of the present system and method is that they may require no change to the client TCP, proxy or default gateway configurations. Yet another technical advantage of the present system and method is that they may leverage robust, existing standards and eliminate engineering effort that would otherwise be spent developing custom protocols.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention may become apparent upon reading the following detailed description and upon reference to the accompanying drawings in which:

FIGURE 1 is a functional block diagram of one embodiment of the present system;

FIGURE 2 a more detailed functional block diagram of the system illustrated in FIGURE 1.

FIGURE 3 is a flow diagram illustrating the method of operation of one embodiment of the present system; and

FIGURE 4 is an example of a universal resource locator employed by one embodiment of the present invention.

While the invention is subject to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and the accompanying detailed description. It should be understood, however, that the drawings and detailed description are not intended to limit the invention to the particular embodiment which is described. This disclosure is instead intended to cover all modifications, equivalents and alternatives

falling within the spirit and scope of the present  
invention as defined by the appended claims.

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DETAILED DESCRIPTION OF THE INVENTION

A preferred embodiment of the invention is described below. It should be noted that this and any other embodiments described below are exemplary and are intended to be illustrative of the invention rather than limiting.

Broadly speaking, the present invention comprises a method and system for routing data across heterogeneous networks. In one embodiment, a switching platform is used to reformulate queries generated by a client on one sub-network and to transmit the reformulated queries to a server on a different, incompatible sub-network. Data generated by the server in response to the queries is transmitted to the switching platform, which reformats the data and transmits it to the client. In a basic embodiment, a client on the first network generates a request for information, wherein the request contains an identifier which indicates that the request is intended for the server on the second network. When the switching platform detects the identifier, the request is reformatted and transmitted to the server. The response to the request is returned to the switching platform, which reformats it and forwards it to the client. It therefore appears to the client that the response was originated by the switching platform.

Referring to FIGURE 1, a functional block diagram of one embodiment of the present system is shown. In

this embodiment, heterogeneous network 10 comprises a first network 11 and a second network 12. Network 11 is a general-purpose local area network of a type used in many corporate environments. Network 11 may, for example, comprise an ethernet-based system to which a variety of workstations, printers and other devices are connected.

Network 12 is a special-purpose network which is coupled to general-purpose network 11. Network 12 provides connectivity to devices which are privately accessible within heterogeneous network 10. These devices may include a variety of specialized devices which, in order to maximize their performance, are coupled to a type of network other than the general-purpose network 12. For example, the devices may comprise a plurality of data storage units for a storage area network (SAN). In this instance, network 12 may be based upon a Fibre Channel network. Network 10 is referred to as a heterogeneous network because the protocol used by network 12 is different from, and incompatible with, the protocol used by network 11

Because network 12 is privately accessible within heterogeneous network 10, it may be referred to as an in-band network. Network 11, on the other hand, may exchange data with an external network 13 such as the Internet and may therefore be referred to as an out-of-band network. As shown in FIGURE 1, the in-band and out-of-band networks are coupled to each other via a switching platform 14. As can also be seen from the

figure, switching platform 14 is separate from the default gateway 15, which connects the out-of-band network to the external network 13.

5           The present system makes it appear to the out-of-band network that the switching platform is actually the source of all the data/services (e.g., web pages) when in fact it is not. Because the in-band network is front ended by the switching platform, there is no way  
10   for a client to realize that the switching platform is performing a bridging function to other devices. Although they look like they are all provided by the switching platform, the data/services are distributed among the in-band network devices, which can be  
15   removed, replaced, or reconfigured as necessary. When the in-band network is reconfigured, the switching platform appears to have been automatically updated to reflect the reconfigured services.

20           The present system permits simply browsing to the switch in the same manner as to other servers on the out-of-band network. From the point of view of the client on the out-of-band network, it looks like the switch provides a sort of all encompassing service but,  
25   from an engineering standpoint, this is achieved without having to actually implement all of the included functions in a single piece of hardware. It allows a very flexible configuration with the requirement to change anything.



The present system does not require the reconfiguration or reassignment of the default gateway for the out-of-band network. As shown in FIGURE 1, the default gateway is separate from the switching platform and is not involved in the routing of the data between the in-band and out-of-band networks. The separation of the default gateway functions from those of the switching platform greatly simplifies the engineering of the switching platform, which does not have to be able to handle data which is destined for devices other than the ones connected to the in-band network.

The present system can also be implemented without requiring reconfiguration or reassignment of the proxy server for the out-of-band network. Just as with the default gateway, substantial engineering effort would be required to perform the functions of the proxy server in addition to providing connectivity to the in-band network. The system thereby simplifies handling of traffic between the in-band and out-of-band networks.

Referring to FIGURE 2, a more detailed block diagram of the system illustrated in FIGURE 1 is shown. out-of-band network 11 includes a variety of devices 21-23 which are connected to a network medium 20. In one embodiment, network medium 20 is an ethernet. In-band network 12 similarly includes a plurality of devices 25-27 which are connected to a second network medium 24. In this embodiment, network medium 24 is a Fibre Channel network. Ethernet network 20 and Fibre

Channel network 24 each employs a network protocol which is specifically designed for that type of network. Although both networks use TCP/IP upper-layer protocols, the respective physical layer protocols are incompatible. Consequently, data cannot simply be transmitted directly from one of the out-of-band network devices 21-23 to one of the in-band network devices 25-27. (It should be noted that the use of ethernet and Fibre Channel networks and TCP/IP or HTTP protocols in this system are illustrative of the invention, and other embodiments may use different network media or protocols.)

Out-of-band network 11 includes a client 21 which is used, at least in part, for the purpose of managing heterogeneous network 10. Client 21 may, for example, be a workstation which is used by a network administrator. The network administrator would typically use client 21 to request information from each of the devices in the network. In one embodiment, the network administrator runs a browser on client 21. The browser can be used to view a web page which includes hyperlinks to each of the network devices. When one of the hyperlinks is selected by the network administrator, an HTTP request is generated and transmitted to the device corresponding to the selected hyperlink. When the HTTP request is received by the device, a response (e.g., a responsive web page) is generated and transmitted back to the client. (Because the responding device serves a response to the HTTP request, it may be referred to as a server.) the web

page which is received by client 21 can then be viewed by the network administrator and used as necessary in the management of the network.

5           While this process is sufficient for the management of devices in out-of-band network 11, it is not sufficient for the management of devices in in-band network 12 because the in-band and out-of-band networks use incompatible protocols. Consequently, HTTP  
10 requests which are generated by client 21 cannot simply be transmitted to devices connected to in-band network 12 - these requests are not supported by the protocol of network medium 24. A means to convert the HTTP requests from the protocol of network medium 20 to the  
15 protocol of network medium 24 is necessary. This function is performed by switching platform 14.

          Switching platform 14 has an interface to out-of-band network 11 (an ethernet port) which is configured  
20 to receive and transmit data which is formatted according to the protocol of that network. Likewise, switching platform 14 has an interface to in-band network 12 which is configured to transmit and receive data which is formatted according to the respective  
25 protocol. Switching platform 14 can therefore be thought of as having a server component 28 and a client component 29 - it acts as a server with respect to requests received from client 21, and acts as a client with respect to data which is served by server 27.  
30 Server component 28 is configured to transmit and receive data according to the out-of-band protocol,

while client component 29 is configured to transmit and receive data according to the in-band protocol. Server component 28 and client component 29 are configured to make any necessary translations or interpretations of data which is communicated between out-of-band network 11 and in-band network 12. It is important to note that the present system does not use the switching platform as a default gateway or proxy server for the out-of-band network - the system thereby avoids the problems associated with usurping the normal functions of these devices in most systems.

Referring to FIGURE 3, a flow diagram illustrating the method of operation of the present system is shown. When it is necessary for a network administrator to obtain information from one of the devices on the in-band network, a request for information (request 1) is formulated at the device on which the management function is being performed (the client). This request is formatted according to the protocol of the out-of-band network and transmitted over this network to the switching platform. When the request reaches the switching platform, the switching platform examines the request and identifies it as being directed to one of the devices on the in-band network. The switching platform then proceeds to parse the request so that it can identify the device to which the request should be forwarded, as well as the subject matter of the request. After the switching platform has identified the addressee and subject of the request, this information is used to construct a second request. The

second request is formatted according to the protocol of the in-band network and is transmitted to the addressee device (the server). In other words, the switching platform effectively converts the request originally generated by the client to a request which is properly formatted for transmission over the in-band network.

When the server device receives the request from the switching platform, it generates a response to the request. If the client is a browser which has requested a web page, the server device produces the appropriate web page and transmits it to the switching platform in a format consistent with the protocol of the in-band network. The switching platform receives the responsive data from the server device and reformats it for transmission over the out-of-band network. The reformatted data is then transmitted to the client device, which utilizes the data in the same manner as data received from devices connected to the out-of-band network.

It should be noted that, from the perspective of the client device on the out-of-band network, all of the devices on the in-band network from which information is requested appear to be a single device. This single device has the address of the switching platform and includes all of the functions of the in-band network devices. As far as the network management client is concerned, the network appears to be homogeneous. This is achieved by using a URL scheme

that is imposed upon the client's communications with the switching platform. (It should be noted that a URL scheme is used here because the management system is based on HTTP - other embodiments may use different protocols and different forms of data/service requests.)

The URL scheme is intended to facilitate a simple and flexible method for converting out-of-band-formatted requests and forwarding them to in-band devices. The URL that is originally generated by the out-of-band client includes specific information that the switching platform is configured to identify and recognize as indicating that the request should be passed on to an in-band network device. The information contained in the URL also allows the switching platform to quickly parse and interpret the information.

Referring to FIGURE 4, an exemplary URL 30 used in one embodiment of the present system and method is shown. The information contained in the URL includes the IP address of the switching platform 31, a key word that denotes a particular format for the information in the URL 32, the IP address of the remote device 33, and the subject of the request 34.

The IP address of the switching platform is obviously used to direct the URL to the switching platform. Because this address is not relevant to the

addressee device or the subject of the request, it can simply be discarded by the switching platform.

The IP address of the switching platform is followed by a key word. In the example illustrated in FIGURE 4, the key word is "Profile\_A." Any word may be used as a key word. "Profile\_A" indicates that the information is arranged in a particular manner. In this instance, the information is arranged with the switching platform address, then the key word, then the address of the destination device, then the subject of the request, each delimited by backslashes (\). In short, the key word is followed by a complete URL that can be forwarded to the destination device. Other key words may indicate that the information is arranged in a different fashion. For example, the key word "Profile\_B" may indicate that the URL contains additional, predefined types of information after the key word which have to be interpreted somehow before a URL can be generated and forwarded to the destination device. The use of key words to identify the types of information in the URL allows a great deal of flexibility in interpreting the URL and in accommodating developments relating to URLs and their structure or content. Based upon the key word, the switching platform can easily parse the URL to identify the respective types of information contained therein and construct a corresponding request (e.g., another URL) to the destination device.

As noted above, "Profile\_A" indicates that the IP address of the destination device will immediately follow the key word. Upon detecting this key word, the switching platform becomes aware that it needs to format the subsequent information as a URL to be transmitted over the in-band network. This URL will be addressed to the IP address of the destination device. It should be noted that the IP address of the destination device typically is not one that exists on the Internet. As mentioned above, the in-band network is a private network and is not accessible by external networks or devices. The IP address corresponding to the destination device is most likely one that is made up by the network administrator for use within the local area network. This a very common practice.

The URL scheme is flexible in that the switching platform does not need to know what is being retrieved or to understand most of what is in that URL. It just needs to see a few identifiable parts of the URL and can process it based on those parts. After the URL is processed, the switching platform can formulate a second URL and forward it to the destination device as if the switching platform were directly requesting the subject information.

While the present invention has been described with reference to particular embodiments, it should be understood that the embodiments are illustrative and that the scope of the invention is not limited to these embodiments. Many variations, modifications, additions



and improvements to the embodiments described above are possible. It is contemplated that these variations, modifications, additions and improvements fall within the scope of the invention as detailed within the following claims.

5

CLAIMS:

WHAT IS CLAIMED IS:

- 5 1. A system for routing data across heterogeneous networks comprising:
- a first network having a first protocol;
  - a second network having a second protocol, wherein  
10 the second protocol is incompatible with the first protocol;
  - a first device connected to the first network;
  - a second device connected to the second network;  
and
  - a switch coupled between the first network and the  
15 second network;
- wherein requests from the first device to the second device are formatted according to the first protocol and transmitted to the switch;  
and
- 20 wherein the switch is configured to detect the requests and to reformat the requests according to the second protocol and transmit the requests to the second device.
- 25 2. The system of claim 1 wherein the first network is an out-of-band network and the second network is an in-band network.

3. The system of claim 1 wherein the switch comprises an HTTP server coupled to an HTTP client, wherein the HTTP server is configured to receive the requests formatted according to the first protocol from the first device and wherein the HTTP client is configured to forward corresponding requests formatted according to the second protocol to the second device.

4. The system of claim 1 wherein the system further comprises a default gateway coupled to the first network.

5. The system of claim 1 wherein the system further comprises a proxy server coupled to the first network.

6. The system of claim 1 wherein the system further comprises a firewall which is separate from the switch.

7. The system of claim 1 wherein the request includes an IP address corresponding to the switch and information identifying the second device and the subject of the request.

8. The system of claim 1 wherein the switch is configured to receive the requests and to identify the requests as being directed to the second device.

9. The system of claim 8 wherein each of the requests includes a keyword which indicates that the subject of the request should be forwarded to a device connected to the second network and wherein the switch is
- 5 configured to identify the requests as being directed to the second device by detecting the keyword.

10. A method for routing data across heterogeneous networks comprising:

formulating a first request for data in a first device;

5 transmitting the first request to a switching device via a first network, wherein the first request is transmitted according to a first protocol;

10 formulating in the switching device a second request corresponding to the first request; transmitting the second request to a second device via a second network, wherein the second request is transmitted according to a second protocol and wherein the second protocol is incompatible with the first protocol;

15 formulating a first response in the second device, wherein the first response is responsive to the second request;

20 transmitting the first response to the switching device via the second network, wherein the first response is transmitted according to the second protocol;

25 formulating in the switching device a second response corresponding to the first response; and

transmitting the second response to the first device, wherein the response is transmitted according to the first protocol.

11. The method of claim 10 wherein the switching device comprises a server coupled to the first network and a client coupled to the second network, wherein transmitting the first request to the switching device comprises transmitting the first request to the server and wherein formulating the second request comprises the client formulating the second request.

12. The method of claim 10 wherein the first request and the second request ask for the same data.

13. The method of claim 10 wherein the first response and the second response provide the same data.

14. The method of claim 10 wherein formulating the requests comprises formulating HTTP requests.

15. The method of claim 10 wherein transmitting the first request to a switching device comprises transmitting the first request to a device other than a default gateway.

16. The method of claim 10 wherein transmitting the first request to a switching device comprises transmitting the first request to a device other than a proxy server.

17. The method of claim 10 wherein formulating the first request comprises formulating a uniform resource locator (URL) that includes an IP address corresponding to the switching device and information identifying the subject of the request.

18. The method of claim 17 wherein formulating the first request comprises formulating a URL that further comprises an address of the second device.

19. The method of claim 10 further comprising the switching device identifying the first request as being directed to a device connected to the second network.

20. The method of claim 19 further comprising the switching device formatting the subject of the first request in the second request and forwarding the second request to the second device.

21. The method of claim 19 further comprising the switching device identifying a keyword in the first request, wherein the keyword indicates the format of the information contained in the first request.

22. The method of claim 21 further comprising parsing the information contained in the first request according to the format identified by the keyword.

23. A network interface for enabling communications between a first network having a first protocol and a second network having a second protocol comprising:

a server configured to receive a first request

5 from a device on the first network, wherein the first request contains an indicator that the first request is directed to a device on the second network; and

10 a client coupled to the server and configured to receive information from the server indicating the device on the second network and the information requested from the device on the second network;

15 wherein the client is further configured to generate a second request and to transmit the second request to the device on the second network;

20 wherein the client is further configured to receive the requested information from the device on the second network and to convey the requested information to the server; and

wherein the server is configured to transmit the requested information to the device on the first network.

24. The network interface of claim 23 wherein the server is an HTTP server, the client is an HTTP client, and the first and second requests are uniform resource locators (URLs).



25. The network interface of claim 24 wherein the URL corresponding to the first request includes an address corresponding to the server and wherein the indicator comprises a predetermined key word.

5

26. The network interface of claim 25 wherein the URL corresponding to the first request contains a URL following the key word, wherein the client is configured to produce the URL following the key word as the URL corresponding to the second request.

10

27. The network interface of claim 23 wherein the TCP server is configured to detect URLs containing the key word and the TCP client is configured to generate new URLs corresponding to the detected URLs, wherein the new URLs do not contain the key word.

15

28. The network interface of claim 23 wherein the client is configured to generate requests which are formatted according to a physical layer protocol that is different than the physical layer protocol according to which the first request is transmitted to the server.

20

29. The network interface of claim 23 wherein the network interface comprises a switch containing the server and the client.

25

30

A METHOD FOR ROUTING HTTP AND FTP SERVICES  
ACROSS HETEROGENEOUS NETWORKS

ABSTRACT OF THE INVENTION

5

10

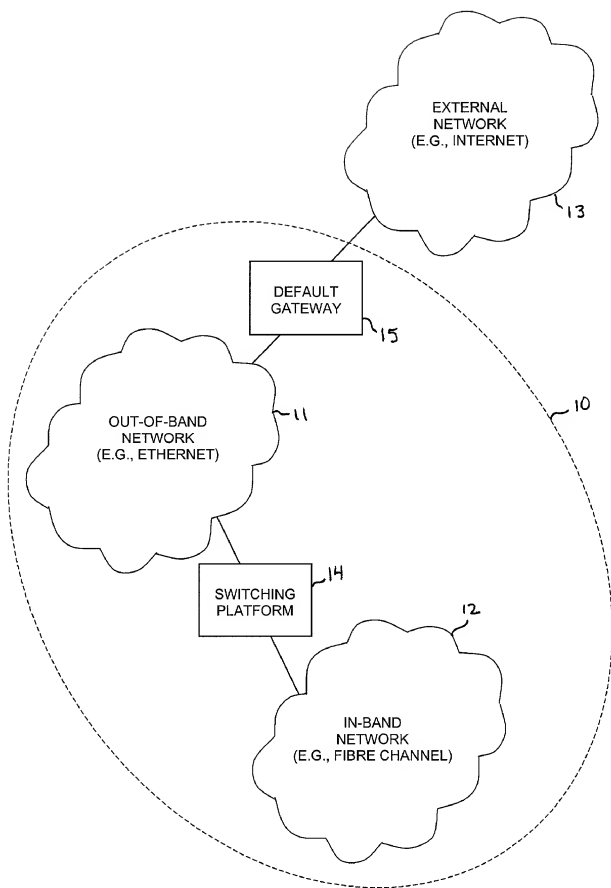
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30

A method and system for routing data across heterogeneous networks. In one embodiment, a heterogeneous network comprises a specialized in-band network that is privately accessible within the heterogeneous network, as well as an out-of-band network that is coupled to the in-band network by a switching platform. A client on the out-of-band network is configured to transmit a request for server data to the switching platform. The request is formatted according to the protocol of the out-of-band network and may take the form of a uniform resource locator (URL). The switching platform is configured to recognize the request as one which is directed to a server on the in-band network. The switching platform parses the request to determine the requested data and reformats this information as a new request that is transmitted to the server according to the protocol of the in-band network. The server provides data responsive to the new request, which is transmitted back to the switching platform according to the protocol of the in-band network. The switching platform then reformats the responsive data according to the protocol of the out-of-band network and transmits it to the client. The switching platform is separate from the default gateway and proxy servers.



**FIGURE 1**

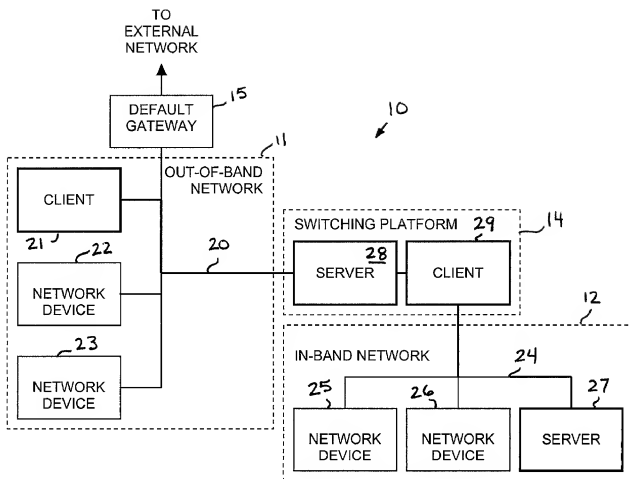
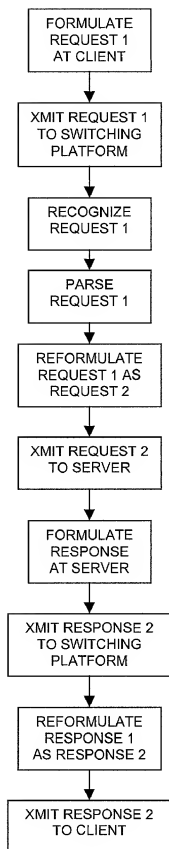


FIGURE 2



**FIGURE 3**

Figure 1. The effect of the concentration of the *Agrobacterium* strain on the transformation efficiency of *Agrobacterium* strain on *Agrobacterium* strain.

### FIGURE 4

|   |                          |                           |
|---|--------------------------|---------------------------|
| <b>DECLARATION FOR<br/>UTILITY OR DESIGN<br/>PATENT APPLICATION<br/>(37 CFR 1.63)</b> | Attorney Docket No.      | <b>CROSS1360-1</b>        |
|   | First Named Inventor     | <b>STEVE KING, ET AL.</b> |
|   | <b>COMPLETE IF KNOWN</b> |                           |
|   | Application Number       |                           |
|   | Filing Date              |                           |
|   | Group Art Unit           |                           |
|   | Examiner Name            |                           |

Declaration Submitted  
with Initial FilingDeclaration Submitted after  
Initial Filing**As a below named inventor, I hereby declare that:**

My residence, post office address, and citizenship are as stated below to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**A METHOD FOR ROUTING HTTP AND FTP SERVICES ACROSS HETEROGENEOUS NETWORKS**

(Title of Invention)

the specification of which was filed on (MM/DD/YYYY)

as United States Application Number of PCT International  
Application Number

and was amended on (MM/DD/YYYY) (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I hereby state I do not know and do not believe that said invention, design or discovery was ever known or used in the United States of America before my invention or discovery thereof, or patented or described in any printed publication in any country before my invention or discovery thereof, or more than one year prior to this application, or in public use or on sale in the United States of America more than one year prior to this application; that said invention, design or discovery has not been patented or made the subject of an inventor's certificate issued prior to the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns; and that I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me which is material to the patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

| Prior Foreign<br>Application<br>Number(s) | Country | Foreign Filing Date<br>(MM/DD/YYYY) | Priority<br>Not Claimed | Certified Copy Attached?<br>YES NO |
|---|---------|-------------------------------------|-------------------------|------------------------------------|
|   |         |                                     |                         |                                    |
|   |         |                                     |                         |                                    |

Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below:

| Application Number(s) | Filing Date (MM/DD/YYYY) |   |
|-----------------------|--------------------------|---|
| 60/202,717            | 05/08/00                 | <input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto |

**DECLARATION – Utility or Design Patent Application**

I hereby claim the benefit under 35 U.S.C. 120 of any United States Application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

| U.S. Patent Application or PCT Parent Number | Parent Filing Date<br>(MM/DD/YYYY) | Parent Patent Number<br>(if applicable) |
|--|------------------------------------|---|
|  |                                    |   |
|  |                                    |   |

Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a below named inventor, I hereby appoint the registered practitioner(s) associated with **Customer Number 25094** to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:

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|--|--|---------------|----|-------------------------|-------|---------|---------------|
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| City                                   |  | State         | OR | Zip                     | 97006 | Country | United States |
| Citizenship                            |  | United States |    |                         |       |         |               |
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25094

PATENT TRADEMARK OFFICE

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| Telephone | (512) 457-7016  | Fax | (512) 457-7070 |





**DECLARATION FOR  
UTILITY OR DESIGN  
PATENT APPLICATION  
(37 CFR 1.63)**

|                          |                           |
|--------------------------|---------------------------|
| Attorney Docket No.      | <b>CROSS1360-1</b>        |
| First Named Inventor     | <b>STEVE KING, ET AL.</b> |
| <b>COMPLETE IF KNOWN</b> |                           |
| Application Number       |                           |
| Filing Date              |                           |
| Group Art Unit           |                           |
| Examiner Name            |                           |

☒ Declaration Submitted with Initial Filing      ☐ Declaration Submitted after Initial Filing

**As a below named inventor, I hereby declare that:**

My residence, post office address, and citizenship are as stated below to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**A METHOD FOR ROUTING HTTP AND FTP SERVICES ACROSS HETEROGENEOUS NETWORKS**

the specification of which was filed on (MM/DD/YYYY)

*(Title of Invention)*

as United States Application Number of PCT International Application Number

and was amended on (MM/DD/YYYY) (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I hereby state I do not know and do not believe that said invention, design or discovery was ever known or used in the United States of America before my invention or discovery thereof, or patented or described in any printed publication in any country before my invention or discovery thereof, or more than one year prior to this application, or in public use or on sale in the United States of America more than one year prior to this application; that said invention, design or discovery has not been patented or made the subject of an inventor's certificate issued prior to the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns; and that I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me which is material to the patentability as defined in 37 CFR 1.56.

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| Prior Foreign Application Number(s) | Country | Foreign Filing Date (MM/DD/YYYY) | Priority Not Claimed | Certified Copy Attached? YES NO |
|-------------------------------------|---------|----------------------------------|----------------------|---------------------------------|
|                                     |         |                                  |                      |                                 |

Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below:

| Application Number(s) | Filing Date (MM/DD/YYYY) |   |
|-----------------------|--------------------------|---|
| 60/202,717            | 05/08/00                 | <input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto |

**DECLARATION -- Utility or Design Patent Application**


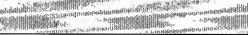
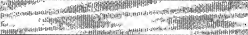


61 hereby claim the benefit under 35 U.S.C. 120 of any United States Application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

| U.S. Parent Application or PCT Parent Number | Parent Filing Date (MM/DD/YYYY) | Parent Patent Number (if applicable) |
|--|---------------------------------|--------------------------------------|
|  |                                 |                                      |

Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a below named inventor, I hereby appoint the registered practitioner(s) associated with **Customer Number 25094** to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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